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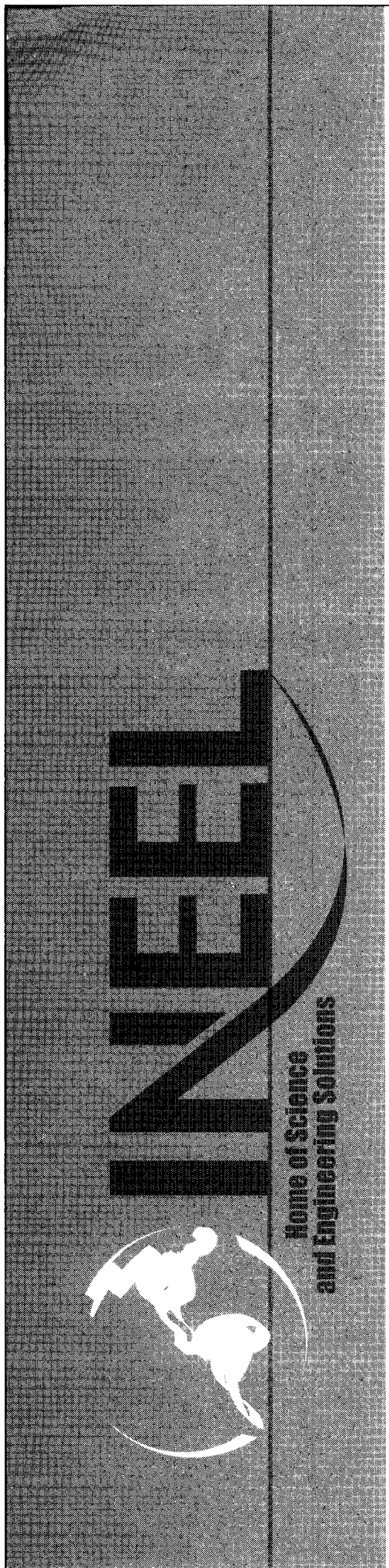
Revision 1



Historical Description of RWMC Surrogate Buried Waste Test Pits for Environmental Restoration Waste Area Group 7 OU 7-13/14

April 2002

Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

INEEL/EXT-2000-00785
Revision 1

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April 2002

Idaho National Engineering and Environmental Laboratory

Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary or Office of _____
Under DOE Idaho Operations Office
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Historical Description of RWMC Surrogate Buried Waste Test Pits for Environmental Restoration Waste Area Group 7 OU 7-13/14

1. INTRODUCTION

This document describes innovative technologies and associated techniques used in constructing and performing full scale demonstrations at the present day cold test pits.

The Cold Test Pits are located at the Idaho National Engineering and Environmental Laboratory (INEEL) Radioactive Waste Management Complex (RWMC) a facility operated for the U.S. Department of Energy (DOE) about 50 miles west of Idaho Falls, Idaho.

These cold test pits were determined to be essential in implementing innovative technology demonstrations to support EM-40 CERCLA treatability studies or other research efforts (i.e. EM-50 R&D technology development, university research, USGS hardware testing, etc.).

In addition, these Cold Test Pits would provide a clean environment to conduct performance and operational testing; and provide an area to construct cold non-radioactive and non-hazardous test pits or cells for innovative retrieval demonstrations and other remedial action scenarios.

The design and construction features of these cold test pits simulate buried waste in the Subsurface Disposal Area (SDA) at the RWMC.

Three locations for field demonstrations were identified and the appropriate documentation (i.e., Cultural Resources Management Clearance, Threatened and Endangered Species Survey, Archaeological Clearance Recommendation, Subsurface Investigation) was prepared and approved. The In Situ Grouting Test Site was located on the North side of the RWMC and inside the old Pit 9 laydown area. This pit has not been used for several years. The other two locations comprise the bulk of the field demonstrations that were conducted. These two areas are referred to as the Cold Test Pit South (CTP-S) and the Cold Test Pit North (CTP-N). Both of these areas are located adjacent to the RWMC. (See Figure 1)

Several individual areas (pits) within the Cold Test Pits have been left intact for current, new, and future technology demonstrations and for those other governmental agencies and universities to utilize as a testing area for new equipment and technologies. Restoration (e.g., complete removal) of the Cold Test Pits will be completed when these and other demonstrations are completed.

A brief overview is provided for each technology being demonstrated. Pit construction features, waste form fabrication pictures and content of the waste forms are also provided. In addition a brief overview of Multiple Subsurface Mapping/Geophysical/Site/Waste Characterization Projects that have been conducted at the cold test pits are also provided.

Details for the demonstrations or projects are contained in the referenced documents. Electronic copies of selected reference documents may be found in the INEEL Hydrogeologic Data Repository (HDR) and in the Environmental Optical Imaging System (ER-OIS). Access to the HDR is accomplished through form INEEL 480.12, INEEL Hydrogeologic Data Repository Information Request. Access to the ER-OIS may be accomplished via the INEEL Internet at http://erois/ois/.

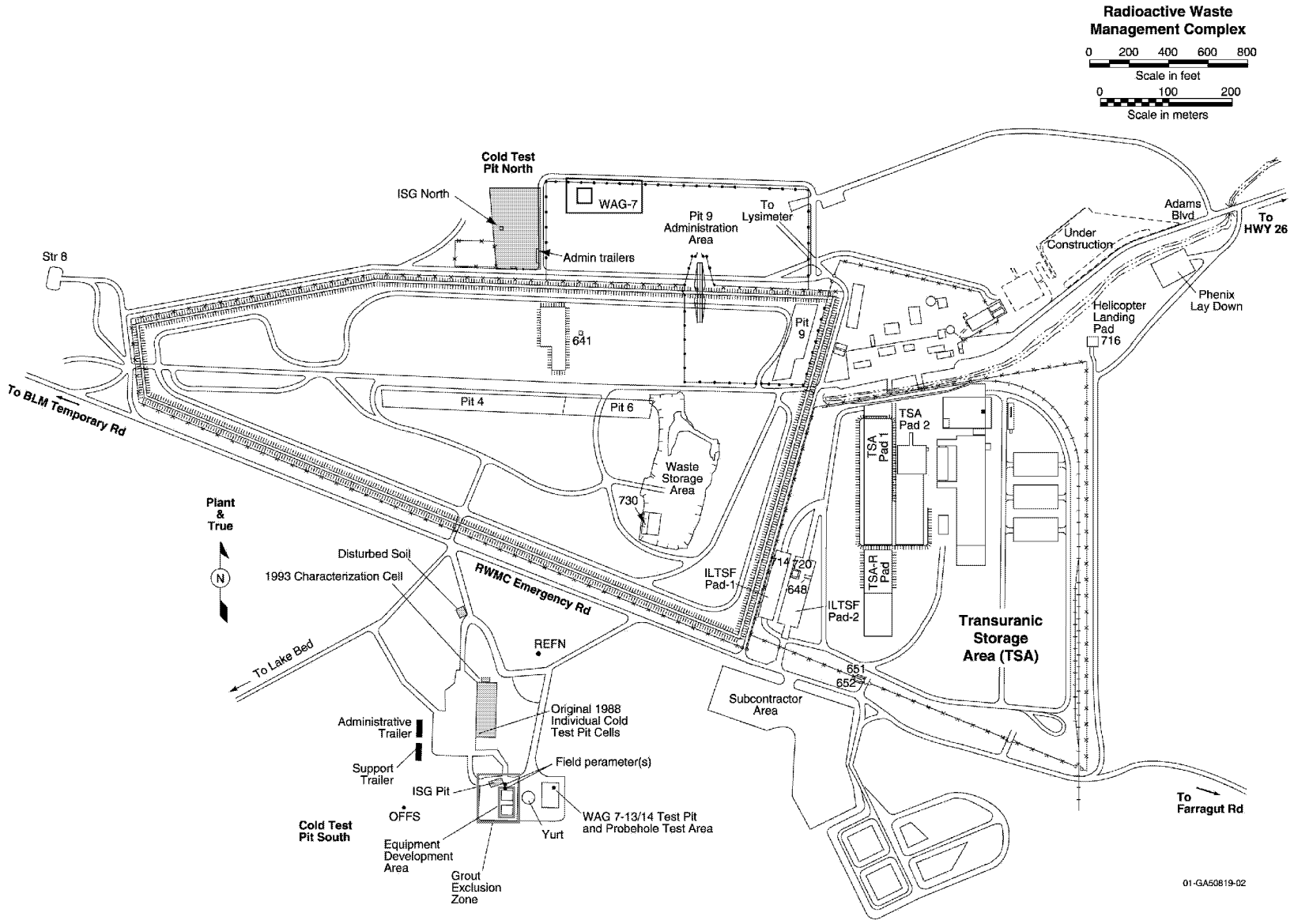

Radioactive Waste Management Complex
0 200 400 600 800
Scale in feet
0 100 200
Scale in meters
Cold Test Pit North
ISG North
WAG-7
Pit 9 Administration Area
To Lysimeter
Admin trailers
Str 8
641
Pit 9
Pit 4
Pit 6
Waste Storage Area
730
To BLM Temporary Rd
Plant & True
N
Disturbed Soil
1993 Characterization Cell
RWMC Emergency Rd
To Lake Bed
REFN
ILTSF Pad-1
714
720
648
ILTSF Pad-2
TSA Pad 1
TSA Pad 2
TSA-R Pad
Transuranic Storage Area (TSA)
651
652
Subcontractor Area
Adams Blvd
To HWY 26
Under Construction
Helicopter Landing Pad 716
Phenix Lay Down
To Farragut Rd
Administrative Trailer
Original 1988 Individual Cold Test Pit Cells
Support Trailer
Field perameter(s)
ISG Pit
OFFS
Cold Test Pit South
Yurt
WAG 7-13/14 Test Pit and Probehole Test Area
Equipment Development Area
Grout Exclusion Zone
01-GA50819-02

Figure 1.

2. COLD TEST PIT SOUTH

2.1 1988 TRU Test Pit (Cold Test Pit)

The cold test pit was initially divided into five cells. Each cell represents a different configuration of the waste. The cells contain random dumped barrels, random dumped barrels and boxes, stacked barrels, stacked boxes, and the large objects pit (see Figure 2). The overall length of the cold test pit is about 145', the width 40' and the depth about 13' (the waste seam is about 8' thick with a 4'-5' soil cap). Each of the barrels and boxes was filled with simulated waste of the type expected to be encountered at the SDA. Items such as metals, tools, plastics, concrete, asphalt, wood, and simulated sludge were placed in each container. (See Figure 3).

The physical excavated area for the pit (5 cells) was approximately 150 ft long × 50 ft wide with the total pit waste dimensions of 145 ft long × 40 ft wide. The approximate waste depth was about 10 ft. with 1-3 feet of soil underburden and 2-3 feet overburden. The pit was then compartmentalized into five cells some interconnected and some separated by earthen berms. Each of four cells contained weighed and counted drums and boxes of known composition. In the 5th cell, unweighed large objects were randomly placed with location and contents unknown to researchers for several initial non-invasive tests.

Further information on partial removal of this pit and other pits is given in the Report, Innovative Subsurface Stabilization of TRU Pits and Trenches, INEL-95-0632, December 1995 and Final Report for the Cryogenic Retrieval Demonstration, EGG-WTD-10397, September 1992.

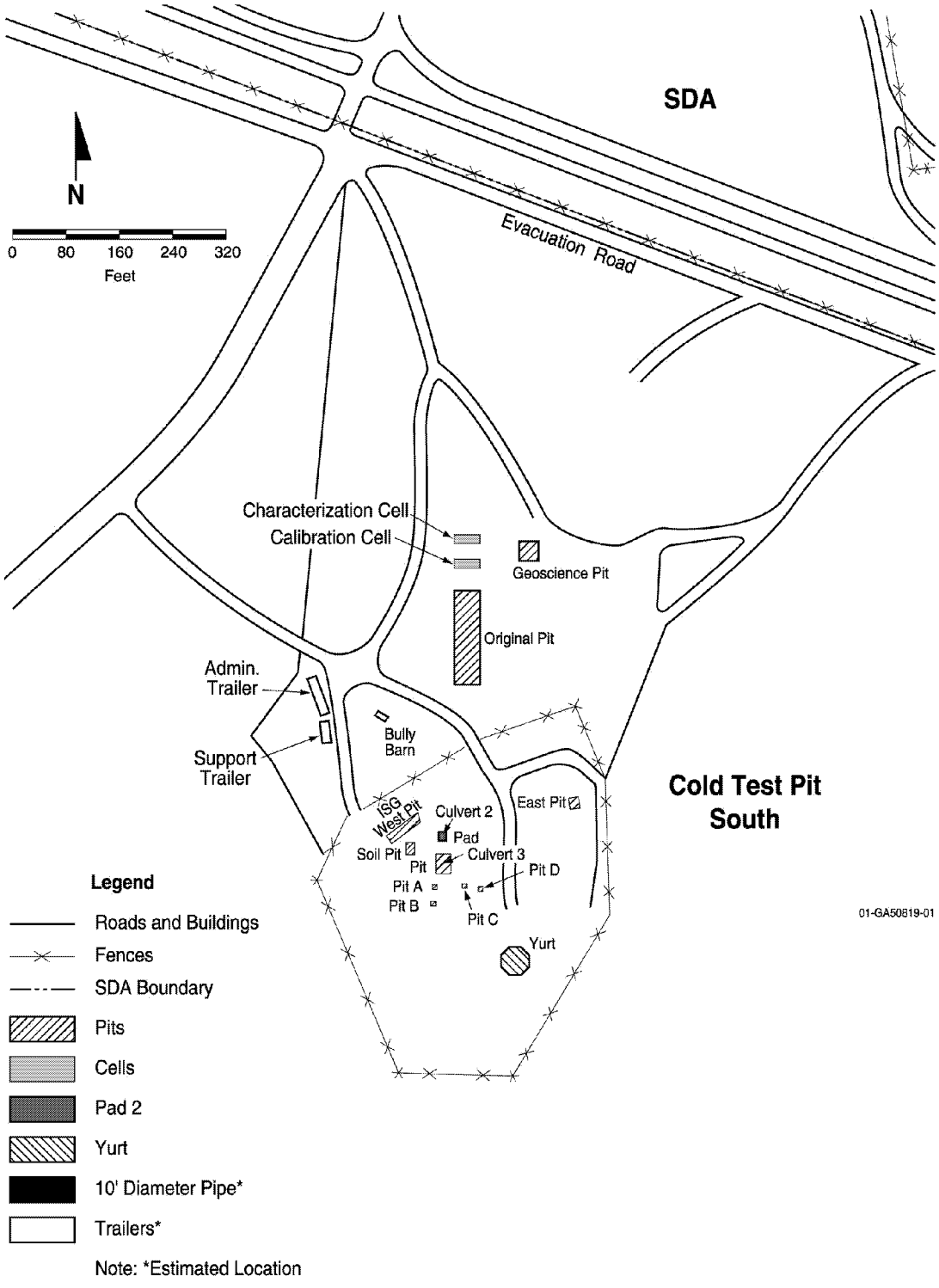


Figure 2. Cold Test Pit South.

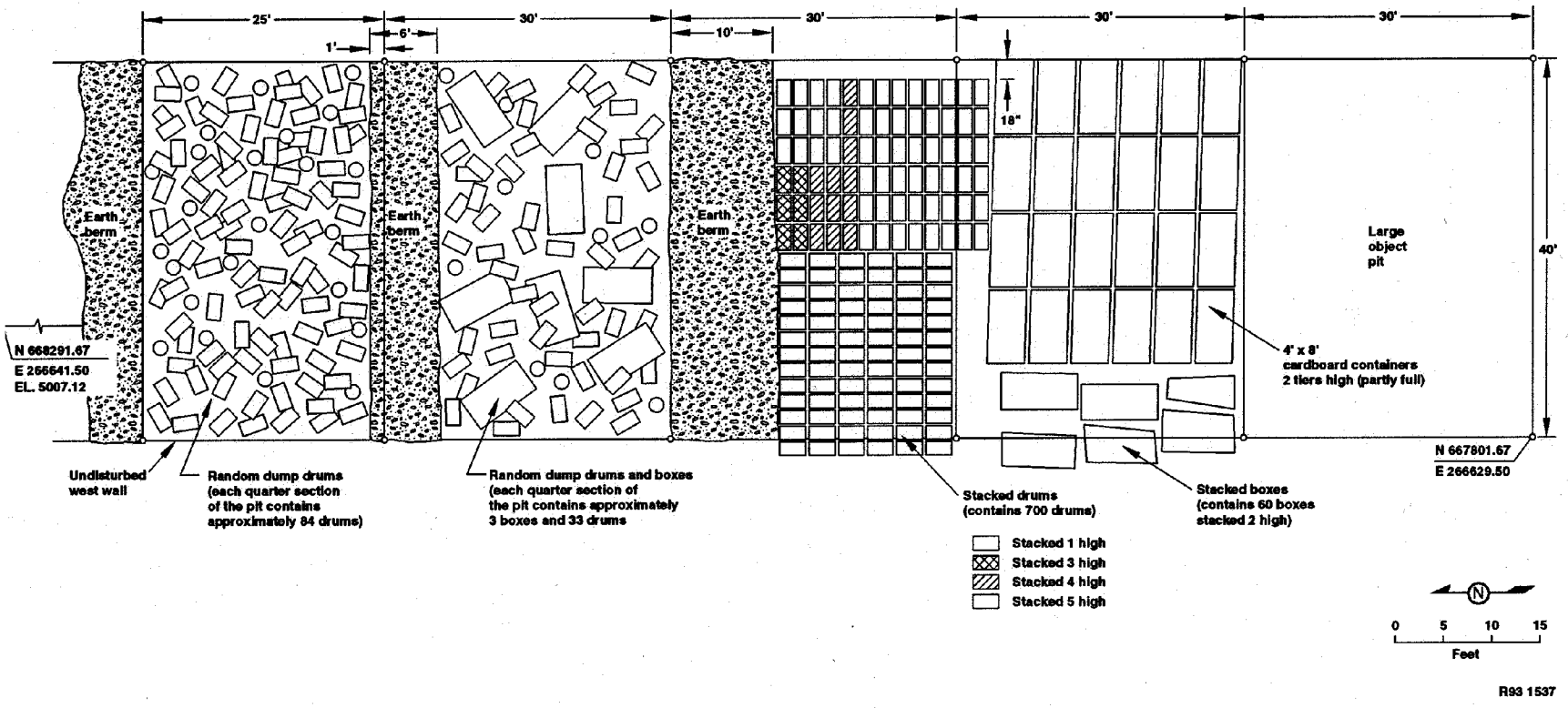

25'
1'
6'
30'
10'
30'
30'
30'
18"
40'
Earth berm
Earth berm
Earth berm
Large object pit
N 668291.67
E 266641.50
EL. 5007.12
4' x 8' cardboard containers 2 tiers high (partly full)
N 667801.67
E 266629.50
Undisturbed west wall
Random dump drums (each quarter section of the pit contains approximately 84 drums)
Random dump drums and boxes (each quarter section of the pit contains approximately 3 boxes and 33 drums
Stacked drums (contains 700 drums)
Stacked boxes (contains 60 boxes stacked 2 high)
Stacked 1 high
Stacked 3 high
Stacked 4 high
Stacked 5 high
N
0 5 10 15
Feet
R93 1537

Figure 3.

Table 1. Cold Test Pit South Original CTP Cell Description.

	Unit	Large object pit	Stacked boxes	Stacked drums	Random dumped boxes and drums	Random dumped drums	Total
Cell	No.	1	2	3	4	5	
Zone	No.		1	2	3	4	
Length	Ft	30	30	20	32	13	145
Width	Ft	40	40	40	40	40	40
Volume	Ft^3	12,000	12,000	800	20,800	5,200	58,000
Vol % Waste	%	18*	65	58	22	26	
Tracer		NA	Neodymium Oxide Nd_2O_3	Terbium Oxide Tb_4O_7	Ytterbium Oxide Yb_2O_3	Dysprosium Oxide Dy_2O_3	
Tracer Content/ drum	G	NA	NA	3.1	4-13	4-13	
Tracer Content/ box	G	NA	630	NA	75	NA	
Total Tracer Content	G	NA	37,800	1,435	1.942	2671	
Tracer Concentration	PPM	NA	480	15	59	56	150

NA- Not applicable, Large Object pit for nondestructive characterization

*Large Object waste volume estimated

Table 2. Original CTP South Cell Contents Description.

Type	Total Weight*	Weight	Total Volume	Volume	Bulk Density	
	Lb.	%	ft^3	%	g/cc	
Large Object						
26 drums	empty metal drums	1400	1.7	191	9	0.12
30 drums	cement filled drums	33000	40	220	10	2.4
3 drums	Metal filled cardboard drums	600	0.7	23	1.1	0.4
5	4" × 10' plastic pipe	60	0.1	4	0.2	0.2
2	4×4×8 concrete vaults	10000	12	256	12	0.6
3	2×2×6 concrete blocks	11000	13	72	3	2.4
1	5×14 large steel tank	8000	10	280	13	0.5
1	2.7 × 10.5 concrete filled cylinder	8700	10.5	58	2.7	2.4
2	2 × 21steel pipes	5000	6	66	3	1.2
8 boxes	4 ×4× 4 empty plywood box	2000	2.4	512	24	0.1
4 boxes	4 ×4× 7 and 4 ×4× 8 empty plywood box	3000	3.6	480	22	0.1
85	**Total**	**82760***	**100**	**2162**	**100**	**0.61**
Stacked Boxes						
60 boxes	Metal , concrete, concrete/asphalt	174,200		7680		0.36
Stacked Drums						
208	Sludge	118,900	56	1528	30	1.25
352	Combustibles	48, 149	22	2586	50	0.30
56	Metals	10,000.	5	411	8	0.39
72	Concrete & glass	34,400	16	528	10	1.0
12	Filter & wood	2,300	1	88	2	0.4

Table 2. (continued).

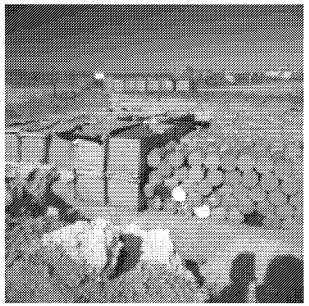
Type	Total Weight*	Weight	Total Volume	Volume	Bulk Density	
	Lb.	%	ft^3	%	g/cc	
700 drums	**Total**	**213,749**	**100**	**5141**	**100**	**0.67**
Random Drums and Boxes						
40	Sludge	23,700	54	294	30	1.29
64	Combustibles	9,530	22	470	49	0.33
12	Metals	2,150	5	88	9	0.39
16	Concrete & glass	8,400	19	118	12	1.15
132 drums	Total	43,780	100	970	100	0.72
12 boxes	Metal, wood, & concrete, HEPA filters.	28,510		1536		0.30
Random Drums						
28	Metals	5,450	5	206	8	0.43
32	Concrete & glass	15,800	15	235	10	1.08
8	Filter & wood	800	1	59	2	0.22
336 drums	**Total**	**105,220**	**100**	**2468**	**100**	**0.69**
	Grand Total	**648,219**		**19935**		**0.52**

2.1.1 Physical Features and Typical Surrogate Waste Forms and Materials


88-165-1-1.bmp


88-272-1-9.bmp


88-300-1-10.bmp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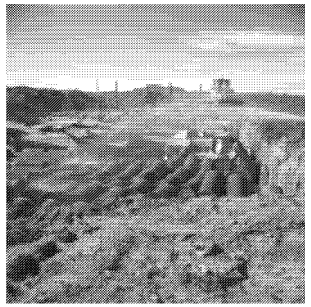
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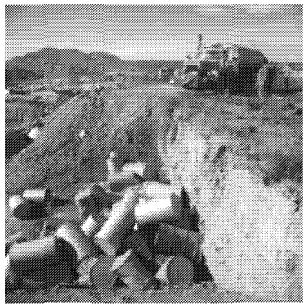
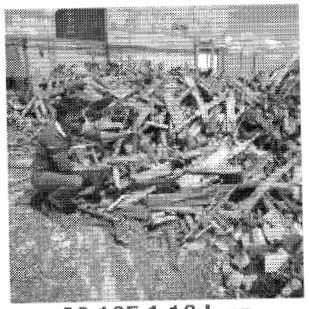

88-307-2-4.bmp


88-307-3-3.bmp


88-315-1-3.bmp

Pit Layout Pictures

88 165-1-1	Empty TRU Test Pit
88-272-1-9	Stacked Boxes
88-300-1 10	Stacked Barrels
88-300-1-7	Stacked Boxes and Barrels
88-307-2-10	Adding Wa:er to ma:erials
88-307-2-4	Random Dump Barrels
88-307-1-3	Random Dump Barrels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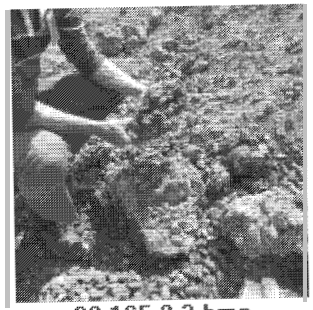
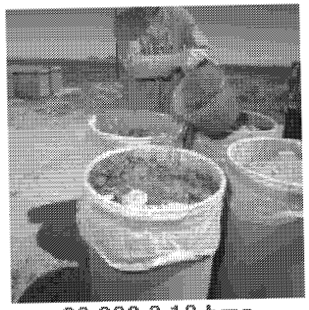
88-165-1-9.bmp


88-165-2-3.bmp


88-165-2-4.bmp


88-208-1-5.bmp


88-208-2-1.bmp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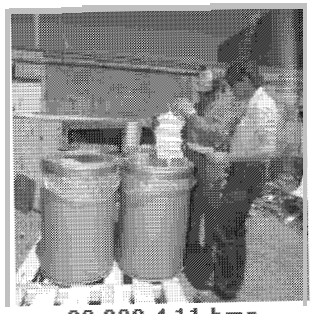
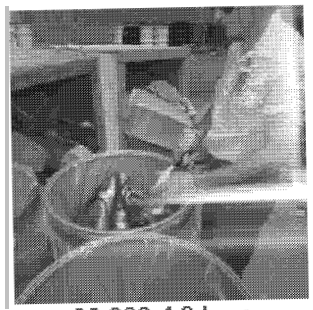

88-208-4-11.bmp


88-208-4-7.bmp


88-208-4-9.bmp

Waste Form Fabrication Activities

88 165-1-10	Combustibles – Wood
88 165-1-9	Asphalt/Concrete/Cinder Block
88-165-2-3	Simulated Sludge Material
88-165-2-4	Metals
88-2080105	Fabrication – Combustibles, Wood
88-208-2-1	Weighing typical box
88-298-3-10	Fabrication - Sludge
88-208-4-11	Fabrication – Combustibles, Paper
88-208-4-7	Fabrication – x, Metal
88-208-4-9	Fabrication – Loading Tracer

2.2 1992 Characterization Cell (Now known as the "Calibration Cell")

In August 1992, a characterization cell was added approximately 33 ft to the north of the CTP. This "1992 characterization cell" was renamed in 1993 as the "Calibration Cell". The size of this cell was 40-ft long x 13-ft wide x 10-ft deep as of 1992. The purpose was to test innovative remote characterization technologies particular digface monitoring for retrieval. The pit was more a series of discrete objects than a simulation of a waste pit. Table 3 lists the waste forms placed in specific locations with 6-in. diameter black plastic instrumentation access pipe, located between the waste forms. Waste forms were centered equal distances from the instrumentation access pipes. The eight, 6-in. access pipes provided access to the waste matrix for characterization purposes. Pit contents are described in 1998 Pollution Prevention/Waste Minimization Plan, INEL-96/097 and Historical Description of the Cold Test Pit, WTD-BWIDCT-087-94, March 1994. The pit contents remain intact.

Table 3. CTP South, Calibration cell waste container matrix and packaged weight.

Waste Form	Content Type	Weight	Weight	Volume	Volume	Bulk Density
		Lb.	%	Ft^3	%	
55-gal drum with liner	Concrete	836	14	7	3	1.8
	Foam	3.3	0.1	7	3	0.01
30-gal drum	Salt Water	231	4	4	2	0.9
Metal file cabinets (two)	Empty	110	1.9	32	13	0.06
2 × 4 × 4 ft wood box	Wood & Paper	119	2	32	13	0.06
	Wood & Paper	97	2	32	13	0.05
	Ferrous Metals	904	15	32	13	0.5
	Mixed Metals	554	9	32	13	0.3
	Nonferrous Metals	891	15	32	13	0.4
	Dense-Pack Metals	2180	37	32	13	1.1
Box Total		**2157**	**80**	**192**	**79**	**0.18**
Total		**2693**		**243**		**0.18**

2.3 Retrieval Cell

A Retrieval Cell was added in 1992 to support field demonstrations. The dimensions of this cell were 40-ft long by 10-ft wide. This cell was located 6–ft north of the characterization cell. The retrieval cell was sectioned into 4 zones. Waste forms included metal drums and desks, boxes and drums, and various cardboard and metal drums. The soil and waste for each cell was removed and deposited in the Retrieved Tracer Pit in 1993.

The pit contents remain intact.

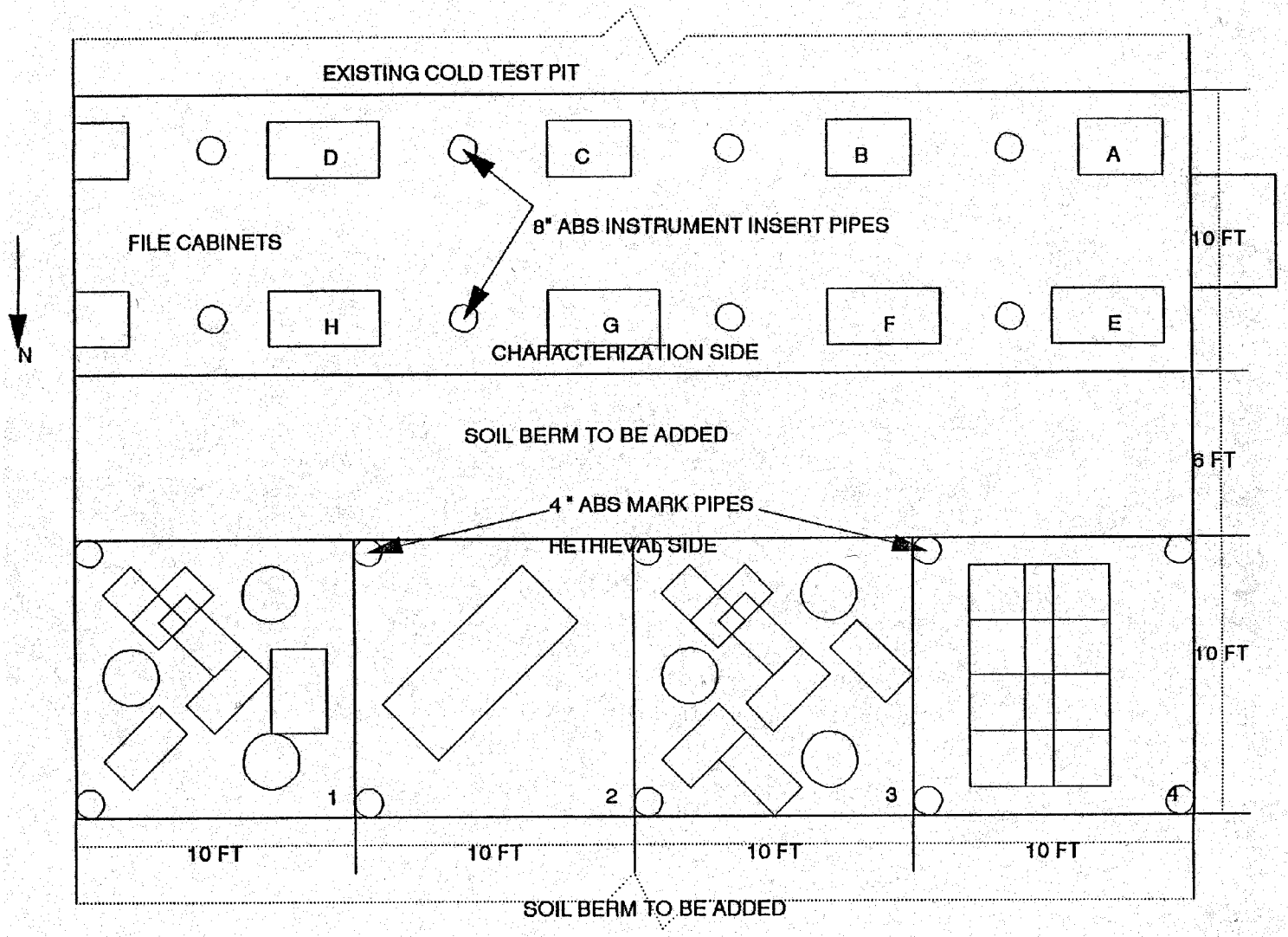

EXISTING COLD TEST PIT
D
C
B
A
8" ABS INSTRUMENT INSERT PIPES
FILE CABINETS
10 FT
N
H
G
F
E
CHARACTERIZATION SIDE
SOIL BERM TO BE ADDED
6 FT
4 " ABS MARK PIPES
RETRIEVAL SIDE
10 FT
1
2
3
4
10 FT
10 FT
10 FT
10 FT
SOIL BERM TO BE ADDED

Figure ??

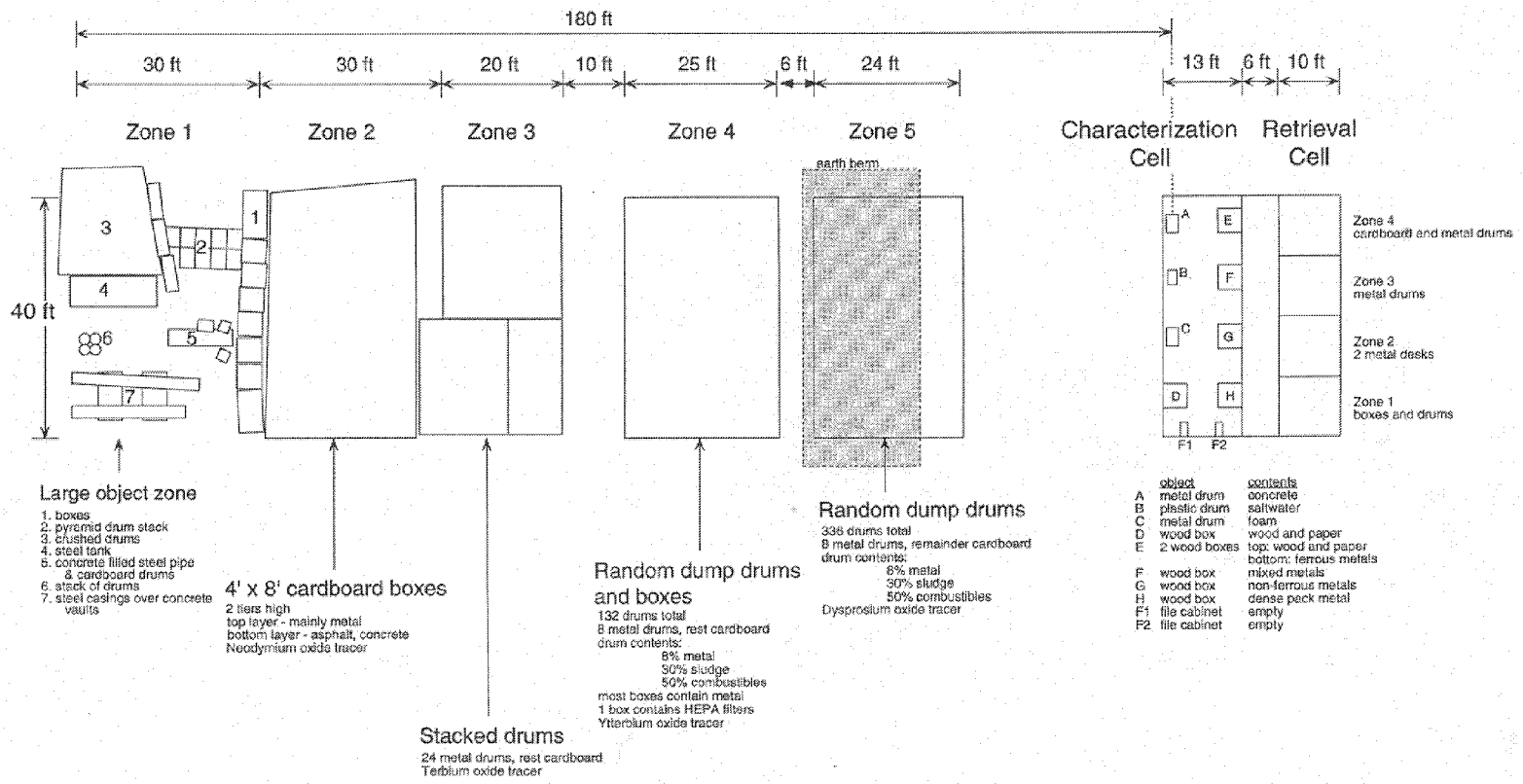


Figure 4. Schematic drawing showing the arrangement and contents of the Cold Test Pit including the location of the Retrieval and Characterization Cells. (Adapted from Loomis, 1989 and Winberg, 1992).

2.4 1992 Cryogenic Retrieval of and Retrieval Test on the Cold Test Pit

EGG-WTD-10397, September 1992, *Final Report for the Cryogenic Retrieval Demonstration* - This technology demonstrated the use of ground freezing and the use of remote operated tools to break out and extract frozen soil and debris. This process removed small 9 × 9 × 10-ft sections from the side of Cryogenic Retrieval areas Nos. 2, 4 and 5 (Table 4, Figure 6). The areas were frozen with liquid nitrogen from piping in an around the retrieval area. Both soil and waste were removed from areas 4 and 5 but only soil was removed from area 2. About were injected with 124,847 gal (9648 ft^3) of Liquid Nitrogen. The frozen soil was removed with various full sized excavators. The surrounding waste material was left in place. The waste was retrieved while air was sampled to determine if the freezing controlled contamination.

The freezing decreased dust loading in the air and background concentrations of tracers were detected in air filters from two out of the three zones. The retrieved waste matrix revealed a high degree of cohesiveness when wetted. Waste was only encountered in areas 4 and 5 containing drums. The mostly soil with some waste containing tracers was deposited in 16 4'× 4'× 8' boxes. The entire operation was photographed. The surrogate wastes in area 4 contained Ytterbium OxideYb_2O_3, and area 5 Dysprosium Oxide Dy_2O_3. Tracer above background was encountered only in air samples from area 5. The test resulted in 25 4×4×8 boxes or 3200 ft^3 of, 10 from cell five (containing the most tracer) and six boxes from four (containing some tracer above background and 9 from area 2 containing no tracer or waste. The removed waste was sorted to remove metal (freeze pipes). The removed boxed soil and waste from the Cryogenic Retrieval was sorted to remove metal then the paper cardboard and wood waste for each cell was combined with the retrieval cell waste and deposited in the Retrieved Tracer Pit.

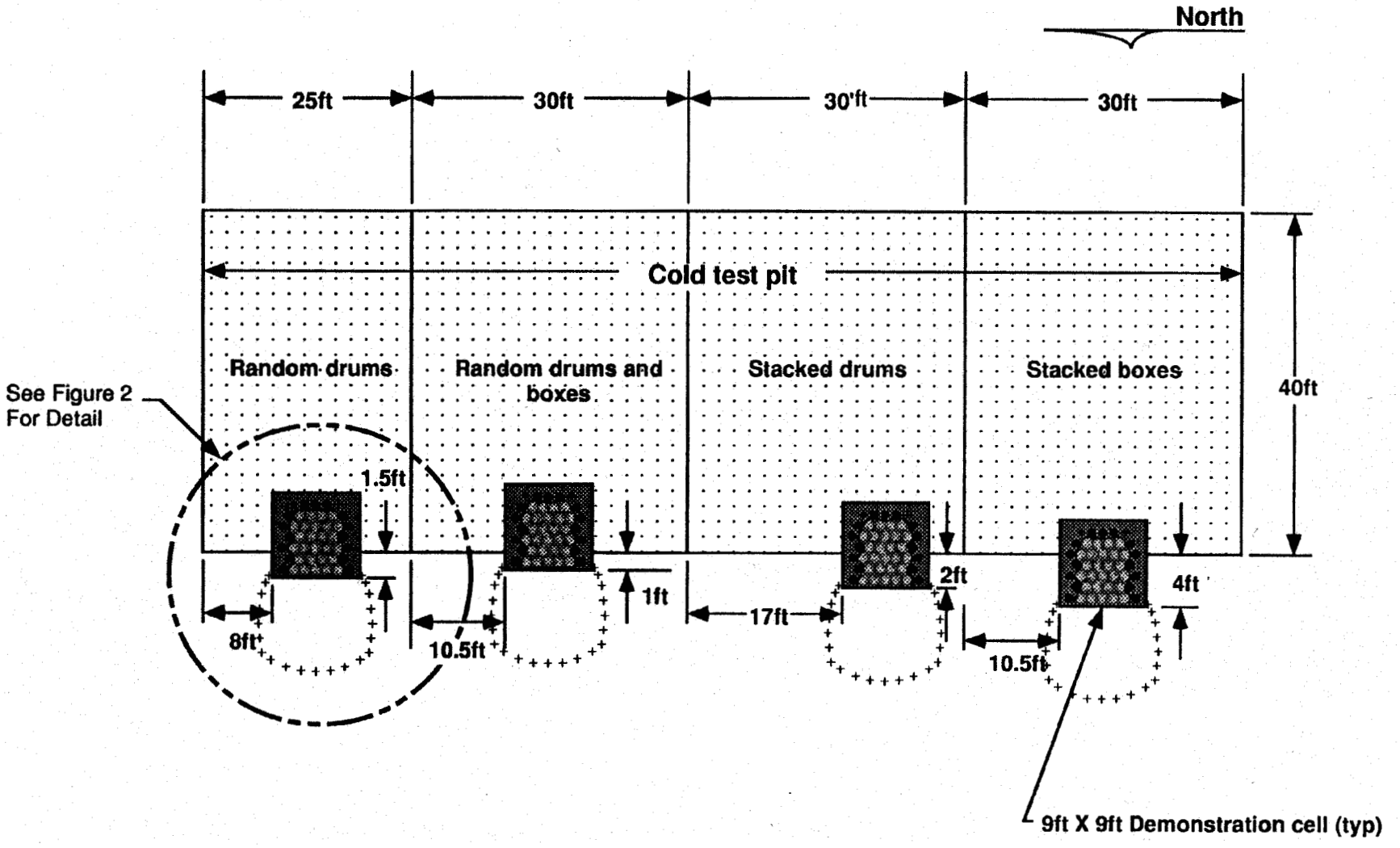

North
25ft
30ft
30'ft
30ft
Cold test pit
Random drums
Random drums and boxes
Stacked drums
Stacked boxes
40ft
See Figure 2 For Detail
1.5ft
1ft
2ft
4ft
8ft
10.5ft
17ft
10.5ft
9ft X 9ft Demonstration cell (typ)

Figure ???

2.5 1993 Characterization Cell

A "new" "Characterization Cell" was added in 1993 to support field demonstrations. The dimensions of this cell are 40-ft long × 10-ft wide. This cell was located 27-ft north of the "renamed"1993 Calibration Cell ("old" 1992 "Characterization Cell"). Waste forms included carbon steel, aluminum, copper, stainless steel, plastic (PVC) pipe, concrete, various wood and metal containers, and a dense ferrous source (Historical Description of the Cold Test Pit, WTD-BWIDCT-087-94, December 1993).

2.6 Overburden removal on the Cold Test Pit

In 1993 a soil berm was constructed on the CTP to test overburden removal. A diagram showing this overlaying the CTP is shown in Figure 6. Waste in cells 4 and 5 was contacted as the test progressed. It is not known if tracer was contacted but this soil was also deposited in the retrieved tracer pit.

2.7 1993 Retrieved Tracer Pit

The retrieved tracer pit was constructed for disposition of retrieved rare earth tracer material from the excavation of the original Cold Test Pit cells during the 1992 cryogenics retrieval demonstration and from the 1993 retrieval cell during the remote excavator demonstration. 'Me pit includes soil with the identified tracer material and hand-sorted pieces of cardboard simulated sludge drums, plastic bagged wood chips, plastic bagged shredded cardboard, unused paint rollers and handles, plastic bagged coveralls and coats, gravel, and pieces of broken wood boxes and pallets. Detailed information can be obtained from EDF #12630. (Buried Waste Integrated Demonstration, WTD-BWIDCT-079-93, September 1993). The pit contents remain intact.

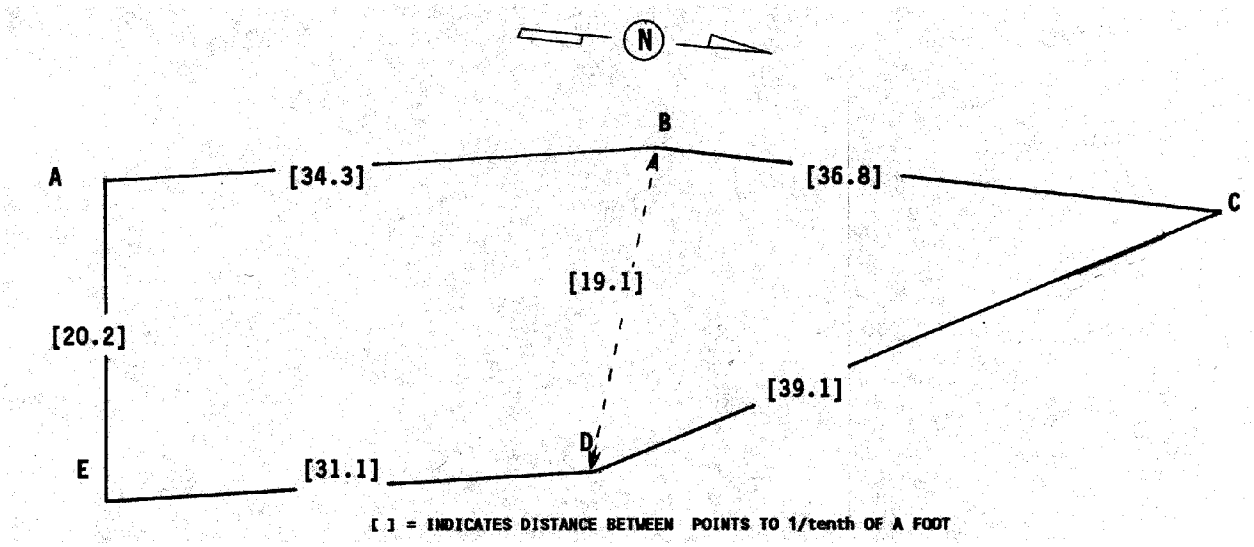


Figure ??

It is assumed that Cold Test Pit soil samples will have elevated amounts of tracer material present resulting from demonstrations and the action of weather upon the surface soils, including windblown spreading during retrieval operations and waterborne spreading of surface exposed material during spring thaw. Other contributions occurred during the 1993 BWID deployment activities. In the overburden demonstration, which used end-effectors, an area was excavated that was spiked with tracer material. This excavated material was placed aside during operations; when the demonstration was completed at the end of 2 weeks, all soil was then placed back in the excavated area, and the Cold Test Pit was re-contoured to level the surface of the original 1988 pit. To minimize spreading, BWID hauled in soil at the end of the 1993 demonstrations, and the whole Cold Test Pit was contoured again to minimize water intrusion during spring thaw. (WDT-BWIDCT-079-93)

2.8 1994 Innovative Retrieval Test Pit

The innovative pit (94-Grout Pit) description and contents are described in the INEL-96/097 and final report, INEL-95/0001. The pit location was determined following an archeological survey, threatened and endangered species survey and Storm Water Pollution Plan and a soil depth profile to basalt. These logging depths are shown in Figure 5. The location, 250-ft south of the original CTP had an adequate soil depth to conduct a new series of stabilization tests. A16 × 12 × 10-ft cell was fabricated using a waste matrix of cardboard boxes, cardboard drums, and metal drums (Table 5.4). The cell was covered with 3-ft of soil overburden, and cement was injected into the waste matrix. The set cement was fractured with a chemical that expands in the grout monolith A dust suppressant was used on the surrounding area prior to excavation. The waste was retrieved while air was sampled. The cement decreased dust loading in the air. The retrieved cemented waste matrix was examined revealing a high degree of grout penetration. The entire contents of the pit were hauled to the CFA landfill as described in the 1998 Pollution Prevention/Waste Minimization Plan.

2.9 1995 In Situ Grouted Wall

In 1995 the original cold test pit. Numbers 4 and 5 were injected in situ under high-pressure injection with cement to form a wall from the undisturbed soil into the waste. This wall can be seen in the figure overlaying the CTP. Fifty-two grout holes were injected with 4,847 gal (648 ft^3) of cement. A grout wall (Figure 6) able to hold a full sized excavator was established. The surrounding waste material was excavated in place and photographed showing the wall and good waste penetration by the cement. Then the grouted wall of simulated waste from both test cells were excavated and hauled to the sanitary landfill at CFA 1998 Pollution Prevention/ Waste Minimization Plan.

2.10 Polymer Pit

The 95-Polymer pit description and contents, are described in INEL-96/097 and final report of grouting is given in, INEL-95/0001. The pit was 26.3-ft wide × 31.5-ft long × 22.1-ft deep. (Tables 5 and 6).

Table 4. CTP South, Innovative grout waste container matrix and weights

Waste Containers	Content Type	Number	Weight	Weight	Volume	Volume	Bulk Density
			Lb.	%	Ft^3	%	
Drums, (cardboard)	Sludge, veg. oil, & kitty litter	8	2322	30	59	19	0.6
	Wood Plastic Cloth Paper	9	898	2	66	21	0.2
	Metal	4	896	12	29	9	0.5
	Concrete	2	438	6	15	5	0.5
Drums, (metal)	Wood Plastic	2	314	2	15	5	0.3
Boxes (cardboard)	Metal	2	2828	37	128	41	0.4
Total		27	7696	100	312	100	0.4

Table 5. CTP South, Innovative grout, Calibration, Characterization, Polymer pits description.

		Calibration Cell	Characterization Cell	Innovative Grout Retrieval	Hard Polymer	Soft Polymer	Total
Depth	ft	10	8	10	6	6	
Length	ft	40	40	10	9	9	
Width	ft	13	10	10	4.5	4.5	
Pit Volume	ft^3	5200	3200	1000	243	243	9886
Vol. % Waste	%	5		31	45	45	

Table 6. CTP South, Polymer pits container matrix and weights.

Waste Containers	Content Type	Number	Weight	Weight	Volume	Volume	Tracer[2] Dy_2O_3	Tracer Dy_2O_3
			Total lb.	%	Ft^3	%	Total g	PPM
Cardboard Drums[1]	sludge, vegetable oil, and kitty litter	6	2644	30	44	20	1200[2]	1000
	Paper Plastic Cloth	7	378	4	51	23	1400[2]	8160
	metal	1	375	4	7	3	200[2]	1175
	metal (80%)/concrete (20%)	13	4149	48	95	43	351[3]	186
Metal Drums[1]	Metal/concrete	3	1128	13	22	10	254[2,3]	496
Total		30	8674		220		3405	865

1. Drums were split between both pits, with the hard polymers getting all three metal drums

2. Tracer was placed at 200 gm/container for sludge, combustibles. Tracer was placed at 27 gm/container for concrete/metal, waste and metal drum waste

2.11 1996 Innovative Subsurface Stabilization Test Area

CTP activities for material testing were documented in the Innovative Subsurface Stabilization Project - Final Report, Rev. 1, INEL-96/0439 July 1997 Final Report. Four new pits were constructed and three large culverts to serve as large scale permeameters were placed south of the original cold test pit and two were filled with simulated wastes following the 1996 field test.

Table 7. CTP South, Pits and Cement Culverts (Permeameters) Description.

	Unit	Pits		Total	Culverts Permeameters		Total
		A	B, C, D		Pad 2	Pad 3	
Depth	Ft	6	6		11	11	
Length	Ft	6	6				
Width	Ft	6	6		10	10	
Volume	Ft^3	216	648	864	864	864	2592
Vol. % Waste	%	44	41	42	26	29	27

A, Pit grouted with Tect

B, Pit used for Acid Pit pretest grouted with TECT-Hg

C, Pit grouted with Wax Fix (Paraffin)

D, Pit grouted with Type H Cement

Pad 2, Culvert Ungrouted

Pad 3, Culvert Grouted with Type H

2.12 Material Test Pits (A,B,C,D)

The construction and contents of material test pits and are summarized in Table 5.6. Four 6 ft × 6 ft × 6 ft pits were loaded with simulated waste, covered with 3 ft of over burden, for in situ jet grouting implementability tests of 4 different agents. Three were grouted with selected test products. Two products, epoxy and hematite, were discarded during field trials. The 4^{th} pit was grouted a year later as a pretest for an actual grouting treatability study at the Acid Pit

The 4 pits A through D are located south of the original Cold Test Pit amidst the polymer pits as shown in figure 5. Pit A was grouted with TECT grout, a proprietary cement grout. Pit B was grouted with WAXFIX a paraffin mixture. Half of both these pits were excavated for visual inspection of the product. This material was then sent to the CFA. Landfill Pit D was to be grouted with a lime slurry/iron sulfate solution but this could not be injected so a Type H cement was injected. Pits A, B, and D were excavated for visual examination demonstrating fill of both waste containers and interstitial soils. Excavated material was sent to the landfill. Approximately 190 ft^3 (1425 gal) of these materials for each product was injected or 87% of the entire waste volume.

The Pit C (1997 Debris Pit) was not used at the time A, B, and D were used. It was partially grouted during a pretest for grouting the Acid Pit 2 years later. TECT-Hg grout was used in part of the Pit as described in the Acid Pit Stabilization Project (Volume 1-Cold Testing), INEEL/EXT-98/00009, January 1998. Pit C was excavated and material was removed in 1996.

Table 8. CTP South, Subsurface Stabilization Test Area Pit Contents.

TYPE	PIT A (TECT) #	WT lb.	Vol. ft^3	Vol. %	PIT B (Paraffin) #	WT lb.	Vol. ft^3	Vol. %	PIT C (Acid Pit pre-test ,Tect-Hg) #	WT lb.	Vol. ft^3	Vol. %	PIT D (Type H Cement) #	WT lb.	Vol. ft^3	Vol. %
Layer 1 (Bottom)																
Soil	3	810	12	30	2	474	8	25	1	280	4	11	2	566	8	25
Wood, Paper	4	193	16	40	4	226	16	50	4	213	16	44	3	176	12	37
Sodium Sulfate	1	314	4	10	1	315	4	12	1	314	4	11	1	315	4	12
Sludge		0	0		1	229	4	12	1	215	4	11	1	245	4	12
Metal	2	170	8	20		0				0			1	197	4	12
Metal/ Concrete		0	0			0			2	163	8	22				
Layer Subtotal	10	1487	40		8	1244	32		9	1185	36		8	1499	32	
Layer 2 (Middle)																
Soil		0			1	276	4	14	1	325	4	14		0		
Wood, Paper	2	74	8	28	1	52	4	14	4	165	16	57	1	78	4	12
Sodium Sulfate	1	314	4	14	1	314	4	14	1	315	4	14	1	313	4	12
Sludge	2	443	8	28	1	218	4	14	1	205	4	14	2	444	8	25
Metal/ Concrete	2	259	8	28	3	343	12	43					3	371	12	37
Metal													1	154	4	12
Layer Subtotal	7	1090	28		7	1205	28		7	1012	28		8	1360	32	
Layer 3 (Top)																
Soil						0			1	275	4	14		0		
Wood paper plastic	4	180	16	57	4	171	16	57	1	31	4	14	4	192	16	67
Sludge	2	649	8	28	1	246	4	14	1	216	4	14		0		
Metal/ Concrete	1	109	4	14	1	82	4	14	2	275	8	28	2	285	8	33
Metal		0			1	173	4	14	1	166	4	14		0		
Layer Subtotal	7	938	28		7	672	28		6	966	28		6	477	24	
Total	24	3515	96		22	3121	88		22	3163	88		22	3336	88	

2.13 Field Permeameters

The placement and contents of three large-scale field permeameters are identified in the Innovative Subsurface Stabilization Project - Final Report, Rev. 1, INEL-96/0439 July 1997 and are summarized in Table 5.7. They are 10-ft diameter culverts 11 ft in height with an 8-inch thick cement bottom and lids were used to contain typical surrogate waste. A 10-ft long by 1-ft diameter standpipe was placed in the field permeameters, for hydrostatic head testing. The test field permeameters were placed on 12-ft × 12 ft × 1-ft cement pads for stability placed in the ground with a 3-ft of over burden.

Table 9. CTP South, Subsurface Stabilization Area Culverts (Field Permeameters) Contents.

	Pad 2, Middle Ungrouted					Pad 3, South Grouted				
Layer 1 (Bottom)										
TYPE	**#**	**WT lb.**	**WT % of Total**	**Vol. ft^3**	**Vol. % of Total**	**#**	**WT lb.**	**WT % of Total**	**Vol. ft^3**	**Vol. % of Total**
Soil	1	635	9	7	3					
Wood, Paper	4	237	3	30	14	5	337	4	37	15
Sodium Nitrate	1	511	7	7	3	1	529	7	7	3
Sludge	1	415	6	7	3	1	435	5	7	3
Metal	1	247	3	15	7		0	0	0	0
Metal/ Concrete	3	575	8	22	10	2	578	8	15	6
Layer Subtotal	11	2620	37	88	40	9	1879	24	66	27
Layer 2 (Middle)										
Wood, Paper	4	198	3	29	13	6	285	4	45	18
Sodium nitrate	1	486	7	7	3	4	1139	14	30	12
Sludge			0		0	2	879	11	15	6
Metal/ Concrete	2	448	6	15	7	1	183	2	7	3
Metal			0		0	1	193	2	7	3
Layer Subtotal	7	1132	16	51	23	14	2681	35	106	42
Layer 3 (Top)										
Soil*	3	1710	24	22	10	3	1639	22	22	9
Wood paper* plastic	4	262	4	29	13	2	127	2	15	6
Sludge	1	430	6	7	3		0	0	0	0
Sodium Nitrate*	1	490	7	7	3	1	470	6	7	3
Metal		0	0	0	0	1	173	2	7	3
Metal/** Concrete	2	380	5	15	7	3	480	6	22	9
Layer Subtotal	11	3272	47	83	37	10	2892	41	76	31
Total	29	7024		222		33	7452		248	

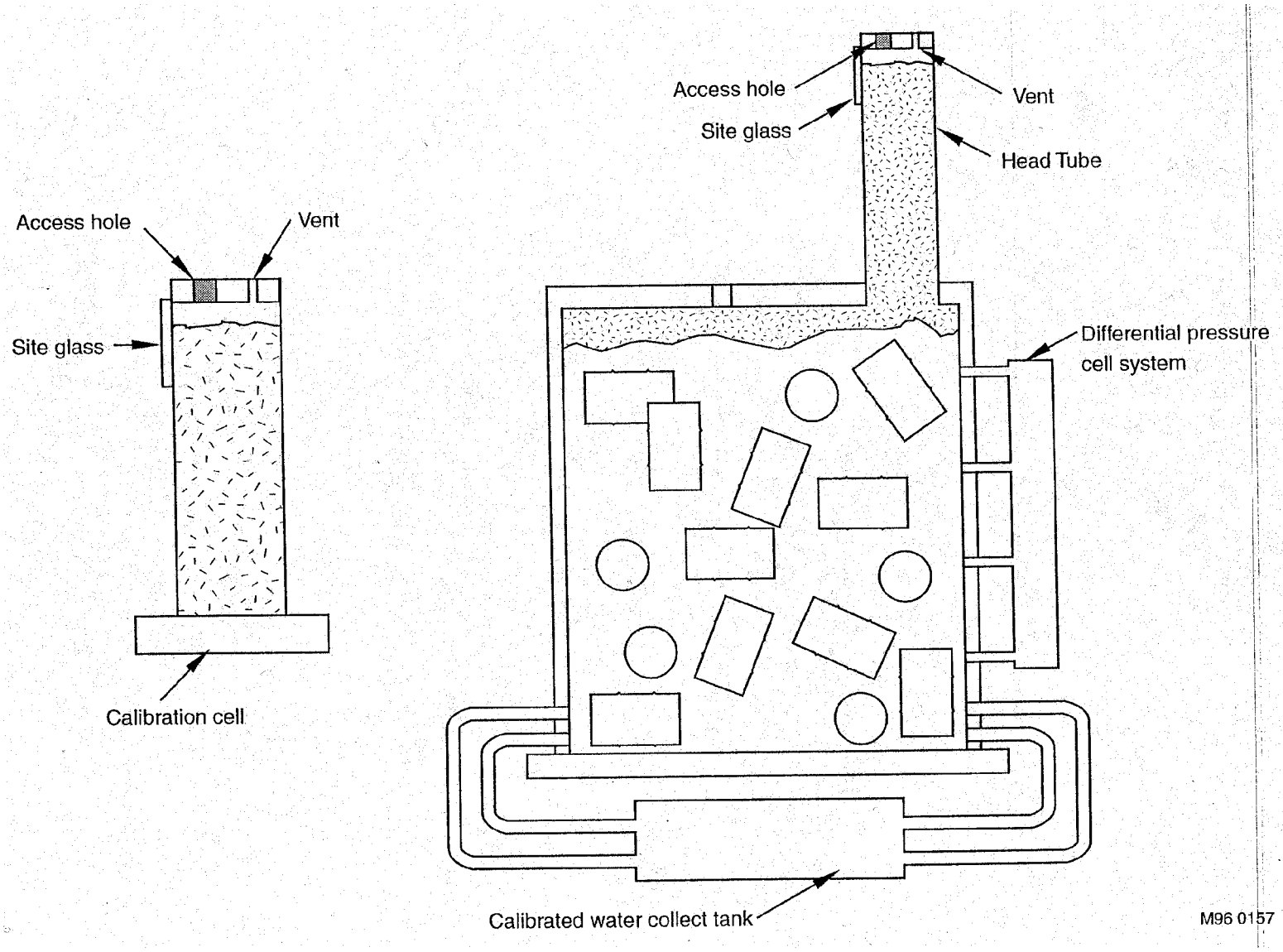
Grey Shaded available for use,

Each Drum Spiked With 200 g C_eO_2

* Weights estimated based on average for waste type

** Contents and weights estimated

Two of the field permeameters were loaded with simulated waste. The southern field permeameter was injected with the grout used in the stabilization field test. The middle field permeameter still contains waste and was used to determine hydraulic flow through disturbed soil. The third permeameter (north) was not used or filled and was removed in 1999.


Access hole
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Access hole
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Head Tube
Differential pressure
cell system
Calibrated water collect tank
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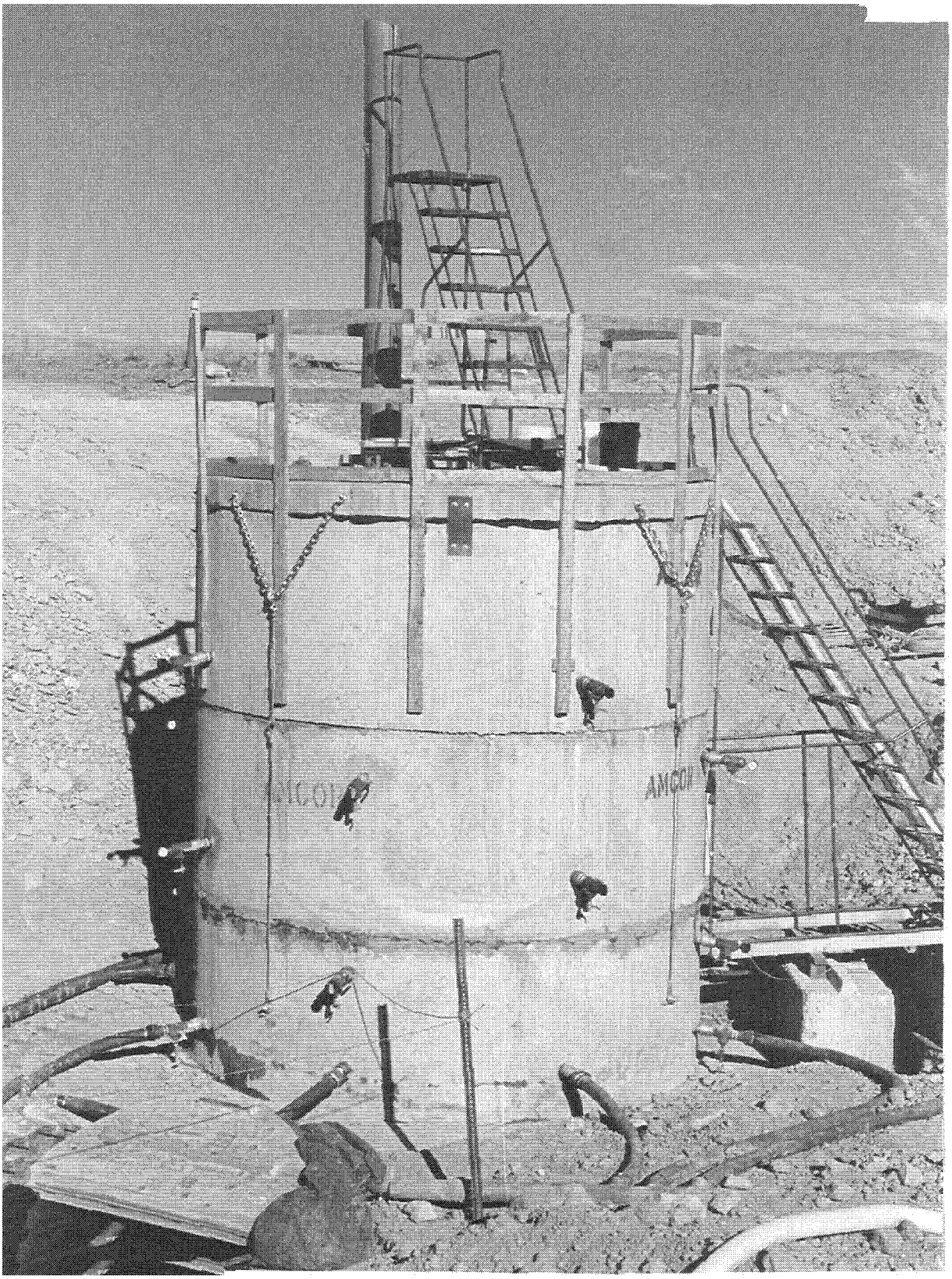
Figure ????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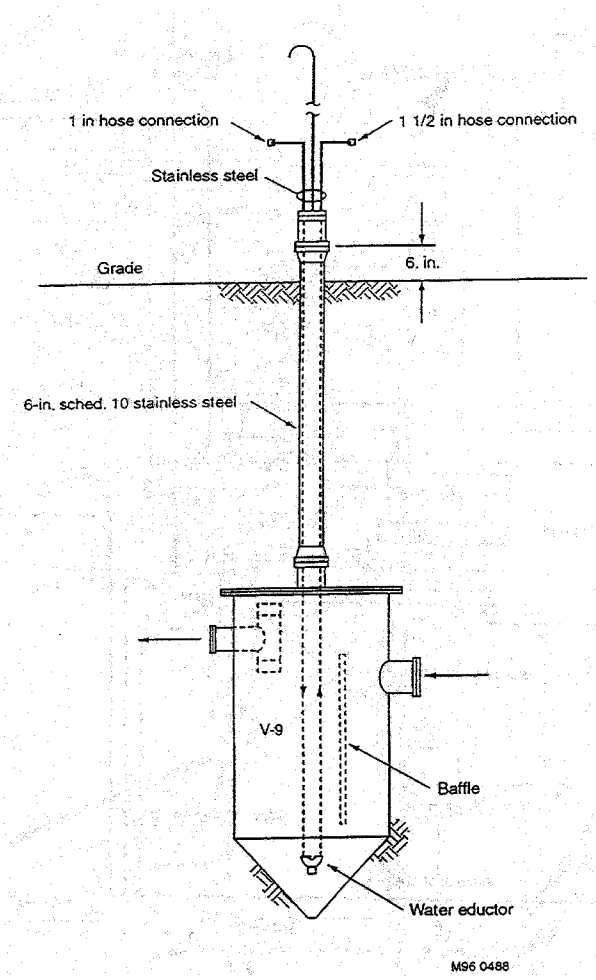
2.14 V-9 Tank Test Area

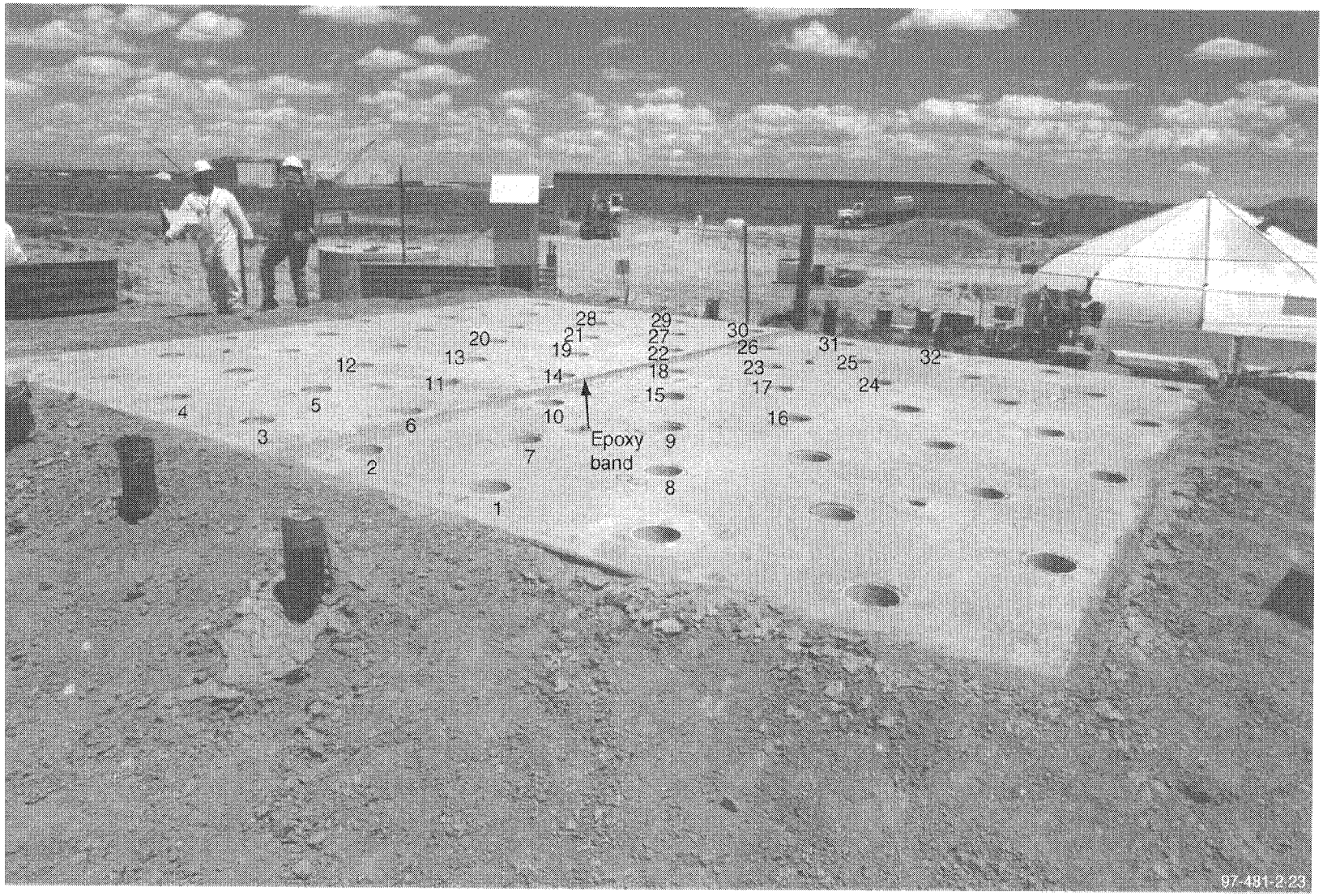
A description of the V-9 tank test is given in Tank Testing Final Report, INEL-96/009 Nov 1997. A tank support stand constructed of three sections of 42-inch diameter concrete culvert was placed in the ground at this location. These sections were 4 feet tall and stacked vertically to give a 12-foot depth, which allowed individual steel tanks to be placed lowered into the culvert, so that the top of the culvert was at surface elevation. This allowed the tanks to be used one at a time with the selected stabilization product. When the product cured, the tank was then lifted from the culvert, set-aside for characterization, and a new tank placed into the culvert for the next test.

Four tanks were mixed with grout and allowed to cure over the winter to determine the affect of a freeze/thaw cycle on the material used. All four tanks were then cut open and visually examined. The metal was removed from the grout and the grout was broken with the bucket on the Front-end Loader to determine the consistency on both sides of the internal baffle. The grout material was sent to the CFA Landfill and the metal was processed through excess property as scrap metal. An additional tank was filled with soil and water and was utilized as a tool for a pre-operational checkout of a technical sampling procedure that will be used in actual sampling of the V-9 Tank. After the completion of this phase of field-testing the tank and support culvert was removed, emptied, and processed through excess property.



2.15 1997 Acid Pit Stabilization Project (Cold Test) Soil Pit

Details for the Soil Pit are identified in Acid Pit Stabilization Project volume 1 – Cold Testing (INEEL/EXT-98-000009) January 1998. The soil pit site was constructed in 1996 and consisted of both disturbed and undisturbed soil. Due to the highly packed clay lithology of the undisturbed portion of the site, grouting caused excessive grout returns and a general ground heave. The primary cause was insufficient void space in the soil to accommodate the injected grout. Further grouting of the undisturbed Soil Pit was abandoned and the grout material was excavated and removed. One section of the thrust block was moved to an area adjacent to the Soil Pit with disturbed soil. A series of grout injections through the thrust block into disturbed soil produced a large monolith. The large monolith was removed intact as a unit with a front end loader for further examination. The monolith was sent to the landfill in FY 1999.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Epoxy band
97-481-2.23

2.16 2000 Soil Subsidence

A small subsidence in the 1992 Characterization Cell (Now known as the "Calibration Cell") was noted in May 2000. The subsidence was located at one end a 4×4×8 wooden box. The lid of the box had decayed to the point that the weight of the saturated overburden (saturation from spring melt) caused the lid to collapse at one end of the box. The time from placing material in the pit to the subsidence is eight years. During that time the lower area of the pit had undergone total flooding during the spring of xxxx. The total flooding added with the normal spring melt which left water standing in the area for 2-3 weeks in the spring, provided some ideal data for comparing material buried under more extreme conditions at the CTPS and those conditions at the SDA.

2.17 1999-2000 Leveling of the Cold Test Pit South

During the summer of 2000 BNFL started excavation for their new facility. Since the clean soil from the excavation was the same as the soil at the CTP-S an opportunity to save money for both BNFL and the CTP-S came up to have the soil moved to the CTP-S instead of 15 miles away to another location. During that time about 800 to 1000 yards of clean soil was delivered and leveled.

GA02-50281-03